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ABSTRACT

In a study of ways of preventing mental retardation in the population of a city slum, surveys were conducted. The major finding was that the variable of maternal intelligence was the best single predictor of the level and character of intellectual development in the offspring. The survey also showed that the lower the maternal IQ, the greater the probability of offspring scoring low on intelligence tests. A longitudinal, prospective investigation was made of the determinants of the kind of retardation which perpetuates itself from parent to child in the "slum-dwelling" family. Using maternal IQ as a basis for selection of a group of newborns, comprehensive intervention in the social environment was undertaken with 40 newborns of mentally retarded mothers (IQ less than 70). The objective of this intervention was to displace all of the presumed negative factors in the social environment of the infant. The age range of the children was about one year, with the oldest being about four years. Results showed that the experimental children at 42 months surpassed the control group on the order of 33 IQ points, and had a learning capacity surpassing that anticipated. It is hoped that the data may prove that it is possible to prevent mental retardation in children reared by parents who are both poor and limited in ability. Nine figures illustrate the study. (DB)

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AN EXPERIMENT IN THE PREVENTION OF CULTURAL-FAMILIAL MENTAL RETARDATION[1, 2, 3]

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AN EXPERIMENT IN THE PREVENTION OF CULTURAL-FAMILIAL MENTAL RETARDATION

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In the United States, it is generally estimated that 3% of the population may be mentally retarded. This amounts to more than 6 million persons. However, in about 80% of this number, there is no identifiable gross pathology of the central nervous system. Furthermore, this group of the mentally retarded, without identifiable pathology of the central nervous system, is almost exclusively found among the populations of economically distressed urban and rural areas.

Dr. Seidenfeld will discuss the recent advent of social concern and the awakening of conxcience concerning America's "poor", and the concern for her racial and ethnic minorities who are so heavily represented among the poverty-stricken. With this stirring of conscience, there has been increasing acceptance, and little critical challenge, of the view that the high frequency of mental retardation found among the "poverty-stricken" is directly attributable to deprivation of opportunities available to the "non-poor" to learn and practice intellectual skills.

However, it should be obvious to all that simple awareness of the high frequency of mental retardation in areas where the economically or otherwise disadvantaged are concentrated, is not sufficient to conclude that social deprivation in the "slum" environment, in any general sense,

causes the retardation encountered there. Such a generalization ignores the fact that most children reared by economically disadvantaged families are by no means retarded. In fact, a majority of children reared in the slums of the cities grow and develop and learn relatively normally in the intellectual sense.

In order to learn more about the distribution of mental retardation in the population of a city slum, we have, over the past few years, conducted a series of surveys. Our survey area is a residential section of Milwaukee (a city of 800,000), which is characterized by census data as having the lowest median family income, the greatest population density per living unit, and the greatest rate of dilapidated housing in the city. For the U. S., it is a typical urban "slum" and yields by far the highest prevalence of mental retardation among school children in the city. In our first survey, all families residing in this "slum" who had a newborn infant and at least one other child of the age of six, were selected for study.

The major survey finding of relevance to this discussion is that the variable of maternal intelligence proved to be the best single predictor of the level and character of intellectual development in the offspring. Mothers with IQ's less than 80, although comprising less than half the total group of mothers, accounted for almost four-fifths of the children with IQ's below 80 (see Table I).

It is generally acknowledged that the "slum-dwelling" children score lower on intelligence tests as they grow older. However, as can be seen here, in Figure 1, the mean measured intelligence of offspring of mothers with IQ's above 80 is relatively constant. And it is only the children of mothers with IQ's below 80 who show a progressive decline in mean intelligence as age increases.

Further, the survey data showed that the lower the maternal IQ, the greater the probability of offspring scoring low on intelligence tests. For example, as you can see in Table II, the mother with an IQ below 67 had a roughly 14-fold increase in the probability of having a child test below IQ 67 as compared with the mother whose IQ fell at or above 100.

In our original survey, the fathers were not evaluated. However, in a second survey of 519 consecutive newborns in our study area, fathers, mothers and all children over the age of two were administered the PPVT of intelligence. The results of this survey added further to our knowledge of the distribution of intellectual functioning within a "slum" population. First, there was a rather striking congruence of maternal and paternal IQ.

TABLE I

Mother's IQ	Percent of Mothers	Children's IQ		
		%>90	% 80-90	%<80
>80	54.6	65.8	47.3	21.9
<80	45.4	34.1	52.7	78.2

Distribution of Child IQs as a Function of Maternal Intelligence

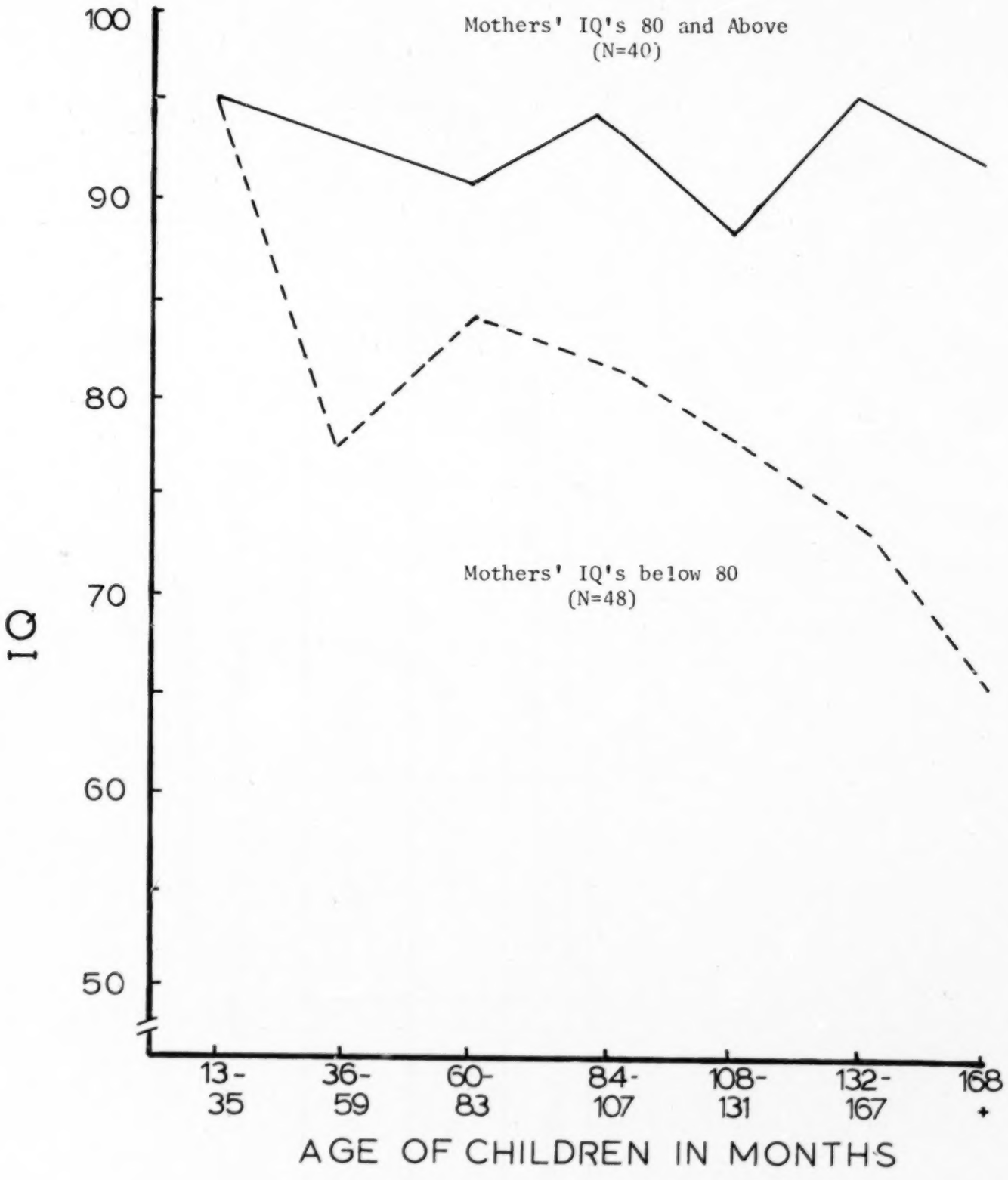

Figure 1. IQ Decrements in Disadvantaged Children Whose Mothers are Mentally Retarded

Source: Heber, R. F., Dever, R. B. and Conry, J. The influence of environmental and genetic variables on intellectual development. In H. J. Prehm, L. A. Hamerlynck and J. E. Crosson (Eds.), Behavioral Research in Mental Retardation (Eugene, Oregon: University of Oregon, 1968), p. 9.

TABLE II

Probability of Child IQ Following Within IQ Ranges as a Function of Maternal IQ

Child IQ	Mother IQ			
	>100	84-99	68-83	52-67
>100	1	.98	.67	.25
84-99	1	1.02	.95	.93
68-83	1	1.57	1.24	2.20
52-67	1	2.36	3.70	14.20

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Of mothers below IQ 70, 65% had husbands who also scored below 70, and only 14% had husbands who scored above 100. By contrast, not a single mother scoring above IQ 100 had a husband who scored below IQ 80. Further, there were approximately twice as many mothers under 20 and over 35 in the below-70 IQ group as compared with mothers above 100. This was reflected in a substantially greater number of offspring in families where both mother and father tested below 70. There was an average difference of 1.2 children between these families and those where the mother and father both tested above 100. Considering that these families were estimated to be, on the average, about half-way through their child-bearing years, the mean difference in the number of offspring in completed families might be on the order of two and one-half. The adverse consequences of this differential in reproductive activity are, of course, of great social concern irrespective of one's views of the etiology of the intellectual deficiency in the parents.

These surveys have convinced us that the very high prevalence of mental retardation associated with the "slums" of American cities is not randomly distributed but, rather, is strikingly concentrated within individual families who can be identified on the basis of maternal intelligence. In other words, the source of the excess prevalence of mental retardation appears to be the retarded parent residing in the "slum" environment, rather than the "slum" itself in any general sense.

At first glance, these population survey data seem to suggest support for the prepotence of hereditary determinants of "cultural-familial" mental retardation. However, simple casual observation suggested that the mentally retarded mother residing in the "slum" creates a social environment for her offspring which is distinctly different from that created by the "slum-dwelling" mother of normal intelligence. As a result, we have been pursuing a longitudinal, prospective investigation designed to contribute to our understanding of the determinants of the kind of retardation which perpetuates itself from parent to child in the "slum-dwelling" family.

We are proceeding to test the social deprivation hypothesis by a methodology which we hope will enable us to determine whether the development of intellectual deficiency may be prevented (as opposed to cured or remediated), by displacing the presumed adverse or negative factors in the social environment of disadvantaged children who become retarded. The results of our population survey data provided us with the ability to initiate a longitudinal research program by providing us with the ability to select a sample which would

be small enough for practical experimental manipulation, but yet which would yield a sufficient number of cases who would later become identifiable as mentally retarded.

As a consequence of the survey data, we have utilized maternal IQ as a basis for selection of a group of newborns, with confidence that a substantial percentage would be identified as mentally retarded as they grow older. By screening all mothers of babies born in our survey area over a period of about one year, we identified mothers of newborns with IQ's less than 70. We have drawn 40 of these mentally retarded mothers from the subject pool and assigned them randomly to either our experimental or our control group. Beginning in the first few weeks of life, we have undertaken a comprehensive intervention in the social environment of our experimental newborns. The objective of this intervention was to displace all of the presumed negative factors in the social environment of the infant being reared in the slum by a mother who is herself retarded. We are, thereby, testing the "social deprivation" hypothesis of etiology by seeing whether it is possible to prevent retardation from occurring in the offspring of these retarded mothers.

Should the experimental children reach the age of 6 or 7 and exhibit normal intelligence, we will know that it is possible, through our experimental program, to prevent mental retardation from occurring at the present high frequency in this group. Should they exhibit a retarded level of functioning, we will know that their intensive exposure to learning experiences was not sufficient to displace their genetic predispositions for intellectual functioning.

The intervention was initiated in the home shortly after the mother returned from the hospital. As soon as a feeling of trust on the part of the mother was achieved, her infant was introduced to our Infant Education Center and she was exposed to a maternal rehabilitation program. The program for the retarded mothers was designed to modify those aspects of the environment which the mother herself creates or controls. These maternal rehabilitation services are in the form of occupational training for the mother as well as training in home-making and baby-care techniques.

At the Infant Education Center, the infants receive a customized, precisely structured program of stimulation. The infants are picked up in their homes early each morning by their infant teachers and are transported to the Center where they remain until late afternoon. Infant stimulation teachers follow an intensive program which has been prescribed

in detail. Essentially, it includes every aspect of sensory and language stimulation which we believe may have relevance for the development of intellectual abilities. Its major emphases are efforts designed to facilitate achievement motivation, problem-solving skills and language development.

In order to assess the effects of this kind of comprehensive intervention into the natural environment of the infant reared by a retarded mother, we are undertaking an intensive schedule of measurements. These include, in addition to the standardized tests of development and intelligence, a number of experimental measures of learning and performance and a variety of measures of language development. Because of the dictates of our sample selection procedure, there is an age range in our infants of about one year, with the oldest of our experimental and control children now being about four years of age.

Because of our time limitation this morning, we can do no more than present findings on a few measures which illustrate the trends in our data. Figure 2 shows the performance of experimental and control groups on an experimental task designed to assess the response strategy employed by the child. It is a matching task in which the child may respond correctly according to color or form. He cannot respond correctly if he follows any other strategy such as position responding or alternation responding. In this case, responding to the dimension of either color or form is more developmentally advanced than the failure to adopt a dimensional strategy. As you can see here, none of the younger controls and only 30% of the older controls showed a dimensional response (that is, in terms of color or form). By contrast, 60% of the younger experimentals and 100% of the older experimentals showed unidimensional responding.

Figure 3 shows performance on another experimental task which also assesses dimensional responding but it is more difficult, in that it is a sorting, rather than matching, task. Here, the younger groups were equivalent in terms of dimensional responding; however, the older experimental group showed 91% dimensional responding as opposed to 50% for the control group.

Figure 4 shows the tendency of experimental and control children to perseverate by continuing to respond to the stimulus, on a discrimination learning task, which has been shifted from the appropriate to the inappropriate choice. For the experimentals, the percentage of children showing a

DIMENSIONAL PREFERENCE IN MATCHING

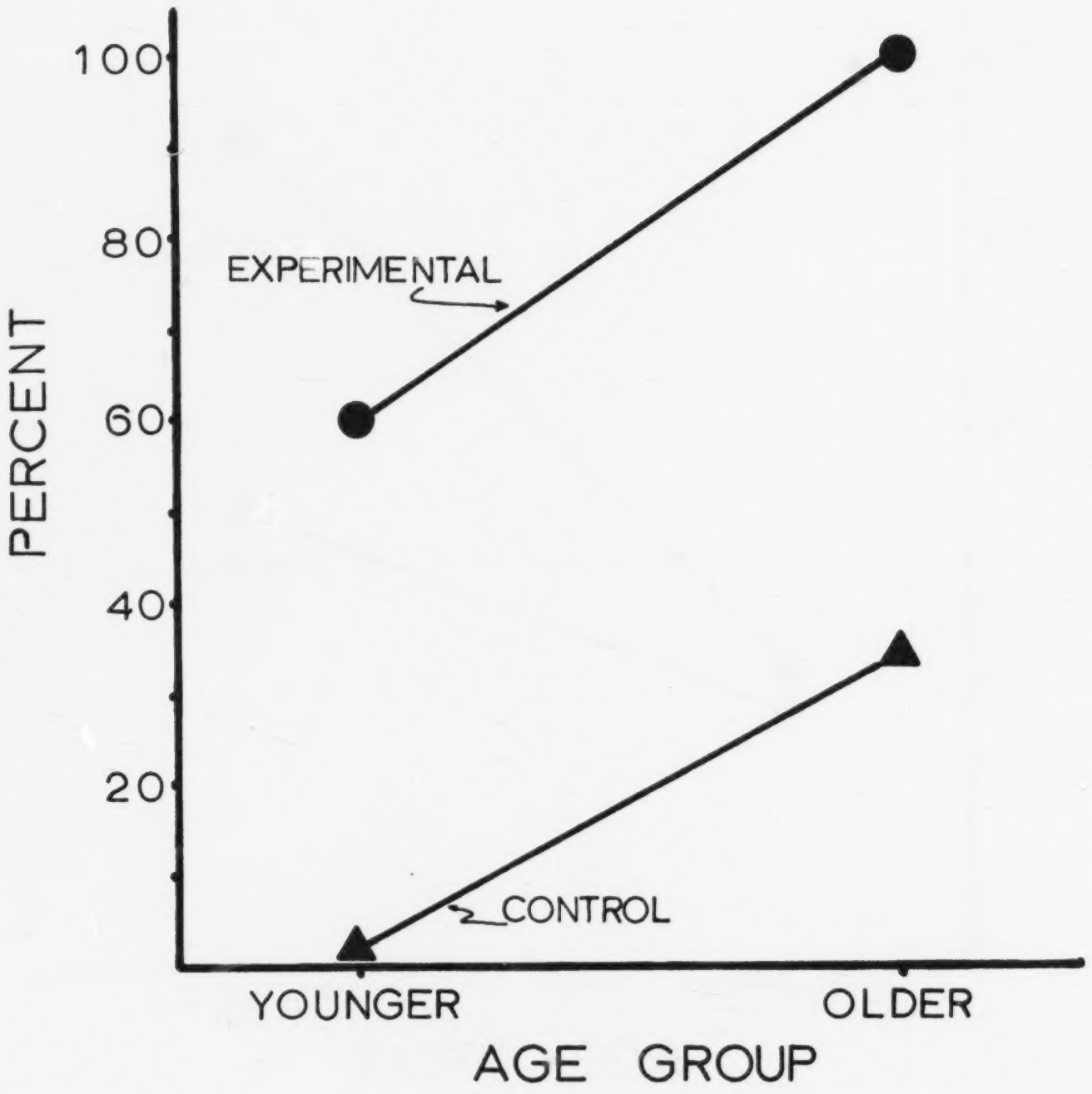


Figure 2.

DIMENSIONAL PREFERENCE IN SORTING

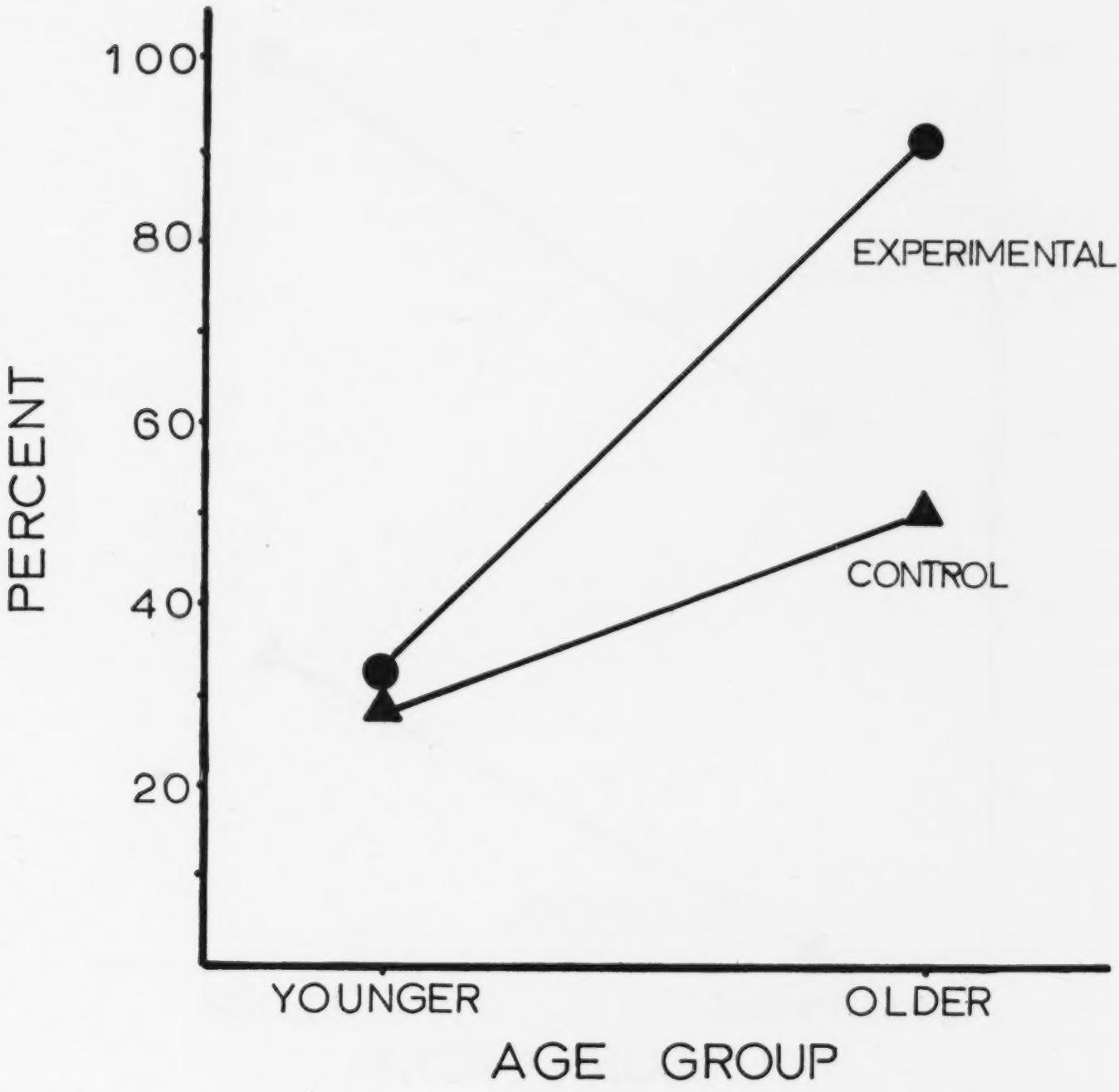


Figure 3.

PERSEVERATION IN PROBABILITY TASK

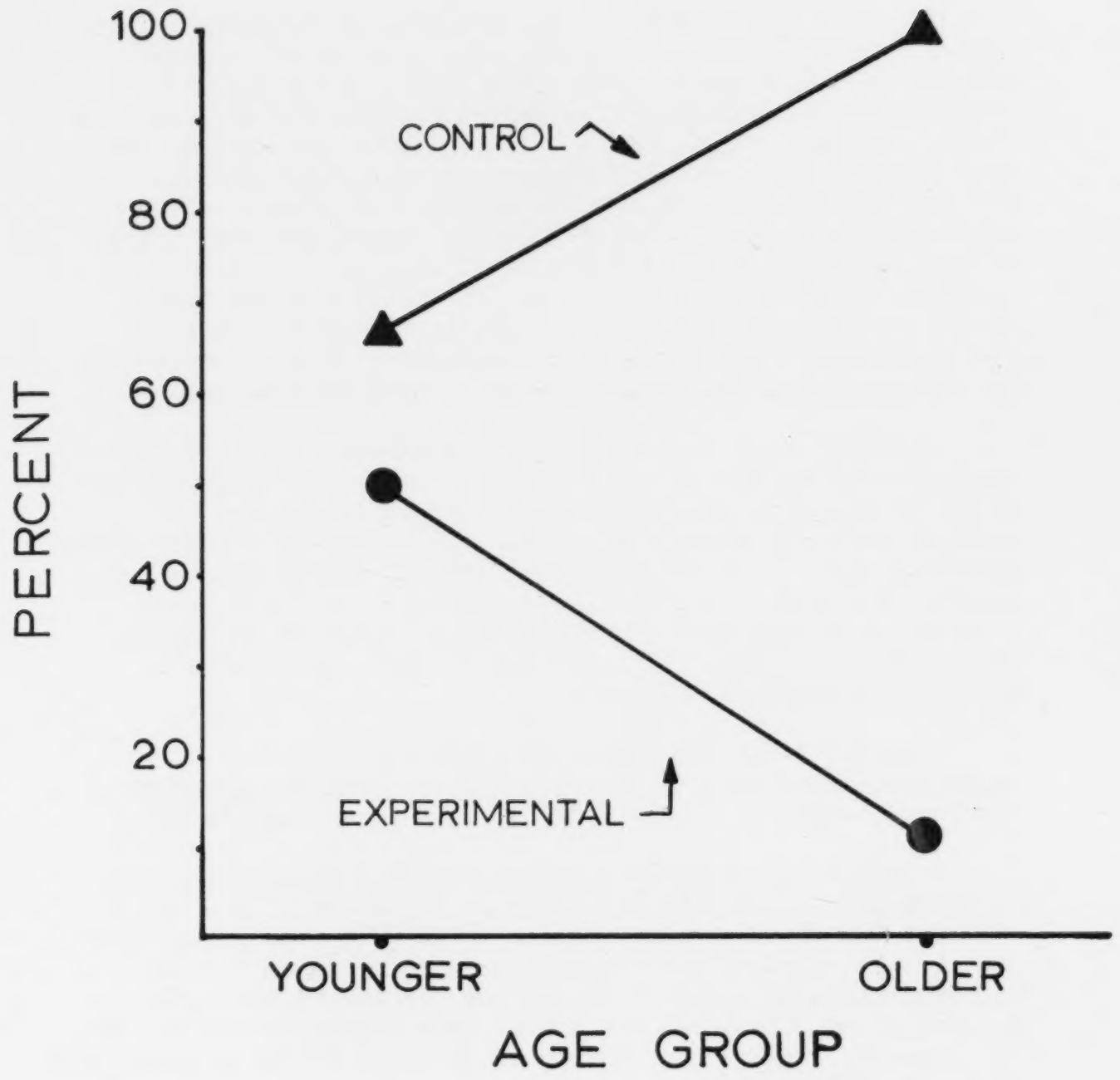


Figure 4.

perseverative response decreased from 50% for the younger group to 19% for the older group. By contrast, the controls actually increase their percentage of perseverative responding from 66% at the younger level to 100% at the older level.

The most striking differences in the performance of the experimental and control children are reflected in the measures of language performance. Beginning at 18 months, free speech samples and formal language tests have been administered every six weeks.

Figure 5 illustrates the total number of different words spoken (per ten minutes time unit) for free speech samples between 19 and 28 months (see Table III). The solid lines include the zero scores for those infants who did not vocalize during the free speech sample. The dotted lines exclude the zero scores. Note the marked spurt in vocabulary production for the experimental group between 19 and 25 months, a spurt which does not begin to occur until 28 months for the control group. And note, also, the number of zero scores which continue to occur at 28 months for the control group. The slight decrease in vocabulary production at 28 months for the experimental group can be accounted for by their beginning to concentrate on the acquisition of grammatical structure.

Figure 6 shows the results of a sentence repetition test administered between 36 and 45 months. This test requires the child to repeat 34 sentences which vary in length and in grammatical complexity. As you can see, there is a substantially greater number of words omitted at all age levels for the control children. For words substituted incorrectly, the control group surpasses the experimental group at 36 months, but at 42 months there are distinctly fewer substitutions made by the experimental group.

Figure 7 shows the number of exact repetitions by the experimental and control groups. The experimental group is distinctly superior to the control group at all age levels.

A test of grammatical comprehension has also been given at three-month intervals beginning at 36 months. This test assesses the child's comprehension of 16 different grammatical features or rules of the English language. Figure 8 shows the percentage of sections on the test performed correctly by each group. Each section of the test refers to one feature of language. Again, the difference in favor of the experimental group is marked.

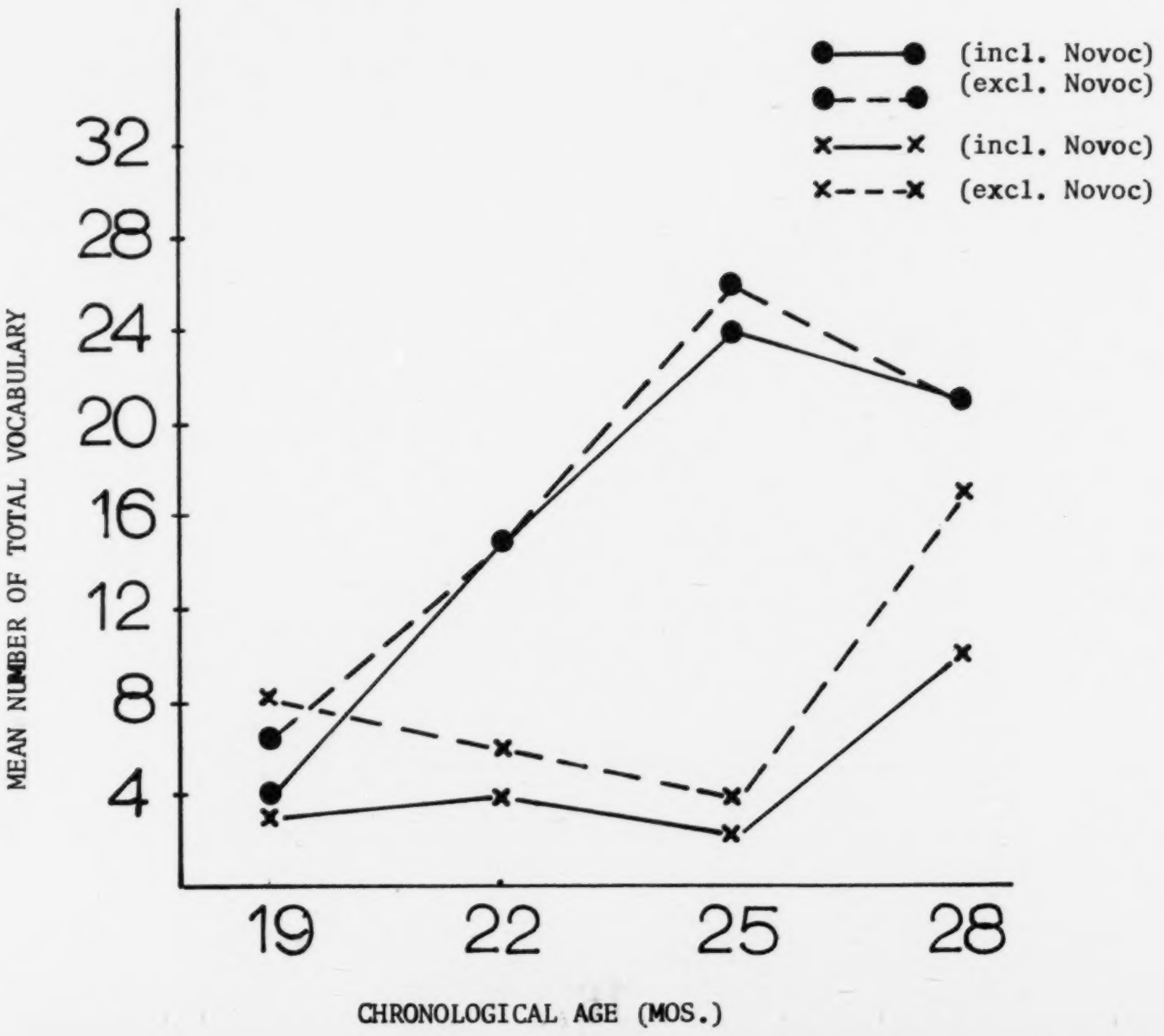
Figure 9 presents Cattel and Binet IQ data, from 24 months on, for the experimental and control groups and for

TABLE III

Quantitative Analysis of Language Sample:
Scores Indicate Number of Total Vocabulary Per
Ten Minute Unit of Time for the
Experimental and Control Groups

Age at Sample		19 Mos.	22 Mos.	25 Mos.	28 Mos.
Experimental Group	$\bar{x}$ (incl. no vocal.)	4.00	14.86	23.69	20.91
	$\bar{x}$ (excl. no vocal.)	6.66	14.86	26.32	20.91
Control Group	$\bar{x}$ (incl. no vocal.)	3.30	3.81	2.31	9.91
	$\bar{x}$ (incl. no vocal.)	8.25	5.44	3.70	17.35

Figure 5. Quantitative Analysis of Language Sample: Scores Indicate Number of Total Vocabulary Per Ten Minute Unit of Time for the Experimental and Control Groups



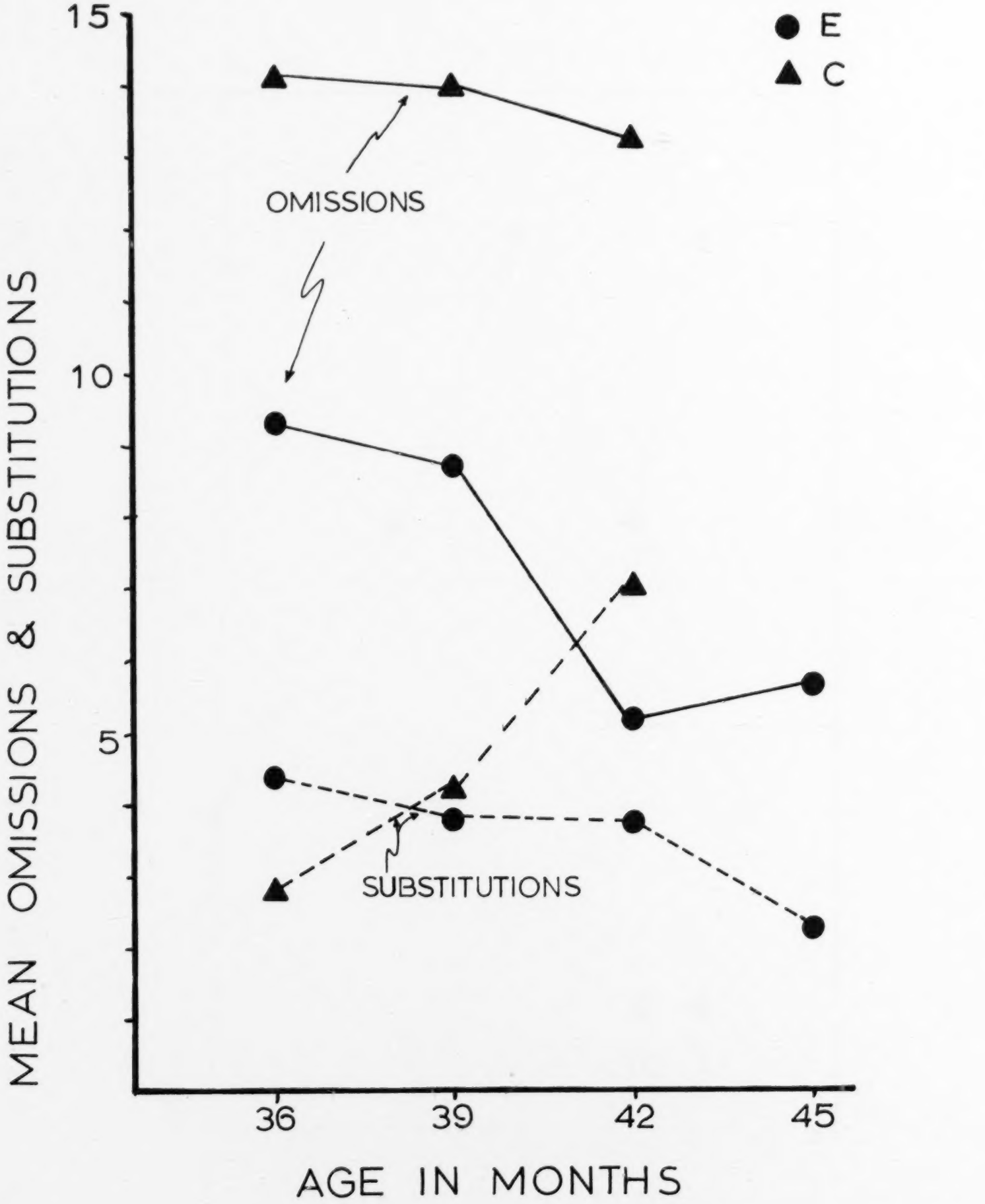

OMISSIONS & SUBSTITUTIONS ON SR TEST
E
C
OMISSIONS
SUBSTITUTIONS
MEAN OMISSIONS & SUBSTITUTIONS
15
10
5
36
39
42
45
AGE IN MONTHS

Figure 6.

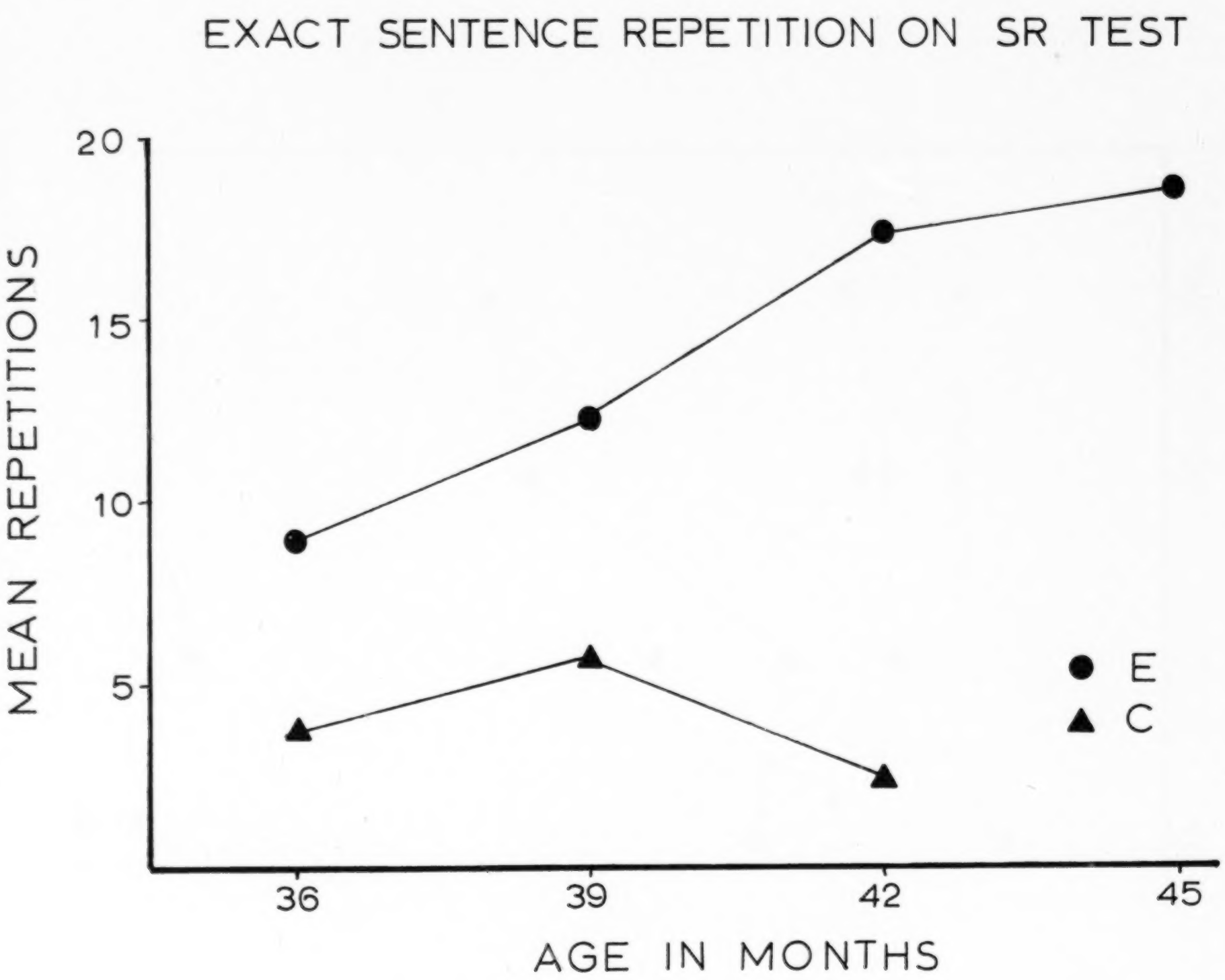

EXACT SENTENCE REPETITION ON SR TEST
MEAN REPETITIONS
20
15
10
5
36
39
42
45
AGE IN MONTHS
E
C

Figure 7.

PERCENTAGE OF SECTIONS CORRECT ON G-C TEST

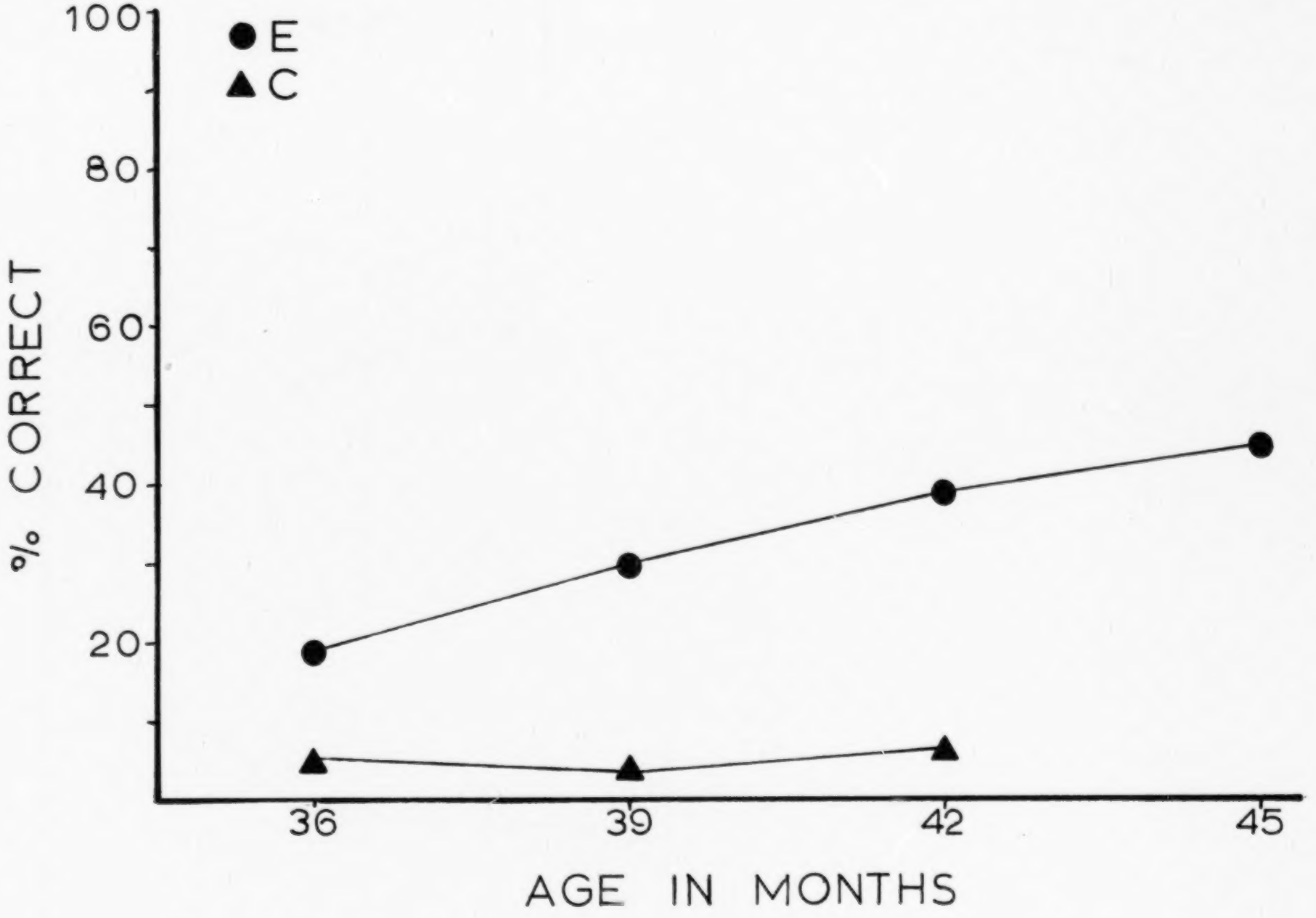


Figure 8.

EXPERIMENTAL, CONTROL, AND CONTRAST GROUP IQ SCORES

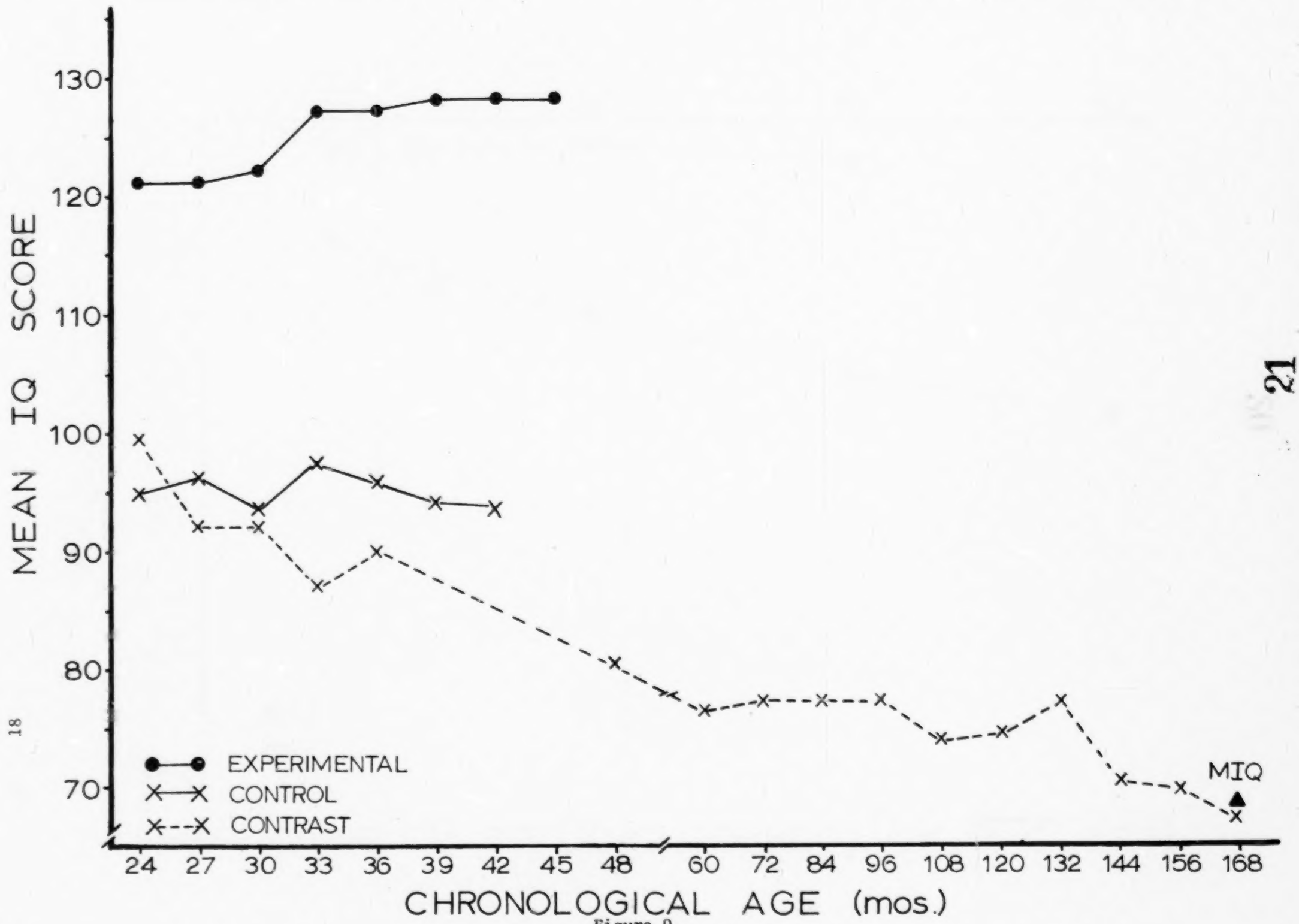


Figure 9.

a contrast group. In effect, it summarizes the present differential in development between the experimental and control groups. The dotted line represents the mean IQ's of offspring of mothers with IQ's below 75, taken from our original population survey. It depicts the patterns of development expected for our actual control group. You can note that the pattern of performance of our control group is not discrepant from the contrast group.

You will recall that our hypothesis was in terms of preventing the relative decline in development of the experimental group which we see in the contrast group and which we expect to see in the control group. We did not anticipate the marked acceleration which you see in the experimental group. At 42 months, the discrepancy between the experimental and control group is on the order of 33 IQ points.

Our awareness of the numerous pitfalls and hazards of infant measurement leads us to extreme caution in interpretation of our present data. Our experimental infants have obviously been trained in skills sampled by the tests and the repeated measurements have made them test-wise. They have been provided with intensive training to which no comparable group of infants has ever been exposed, to the best of our knowledge. Have we, thereby, simply given them an opportunity to learn and practice certain intellectual skills at an earlier age than is generally true? And if so, will their apparent acceleration in development diminish as they grow older?

Nevertheless, the performance of our experimental children, today, is such that it is difficult to conceive of their ever being comparable to the "lagging" control group. We have seen a capacity for learning on the part of extremely young children surpassing anything which, previously, I would have believed possible. The trend of our present data does engender the hope that it may prove to be possible to prevent the kind of mental retardation which occurs in children reared by parents who are both poor and of limited ability.